

Perihelion Passage, April 25th 99867, M.T. at Paris.

Longitude of the perihelion	149° 1' 55".9	} 1815°
" " ascending node	83° 28' 33".6	
Inclination of the orbit to ecliptic... ..	44° 29' 54".6	
Excentricity	0.93121968	
Semi-axis major	17.63383	
Logarithm of perihelion distance... ..	0.0838109	
Period of revolution	74.04913 years.	
Motion—direct.		

These elements represent the normals upon which they are founded very closely, considering that observations of comets in 1815 did not pretend to the degree of precision which is now sought to be attained, and, moreover, were subject in the reductions to errors in the places of the comparison stars.

But Bessel's labours did not stop here. With a special interest in the comet of 1815, not, it may be presumed, alone due to its exceptional character, but in no small degree to the circumstance of its having been detected by his most intimate and revered friend, Olbers, Bessel undertook, and in the year of its appearance accomplished, the laborious task of computing the perturbations of the planets Jupiter, Saturn, and Uranus upon the motion of the comet during the present revolution, and so determining the epoch of the next perihelion passage. The principal details of this work are comprised in the memoir to which we have already referred. The masses of Jupiter and Uranus were Laplace's, while the mass of Saturn was taken from Bouvard's tables. The whole period is divided into three sections, the first extending from August 4, 1815, to July 30, 1833; the second from the latter date, with new values of the semi-axis and excentricity to July 21, 1869, and the second from July 21, 1869, to the next perihelion passage. The action of each of the three planets tends to accelerate the comet's return, that of Jupiter by upwards of two years; the final result indicating an acceleration of 824.51 days, with reference to the period belonging to Bessel's definitive ellipse for 1815; it was thus found that the duration of the actual revolution would extend to 26222.4 days, and consequently the next perihelion passage is fixed to February 9.4, 1887. This conclusion will be affected not only by the imperfect values of the planetary masses which were available when Bessel undertook the investigation, but in a greater degree by the uncertainty which still remained as to the precise length of the revolution at the last appearance; this Bessel found to extend to ± 0.27657 of a year, or 101 days.

With such an amount of probable error attaching to Bessel's result it must soon be a matter for the consideration of the astronomer, whether a nearer approximation may not be yet attained. We have much more accurate values of the masses of Jupiter, Saturn, and Uranus than Bessel possessed, and are able to take into account the influence of Neptune, though this is not likely to be very material. Fortunately, in several series of observations, the observed differences of right ascension and declination between the comet and the comparison stars are preserved to us, and thus we can reduce the observations anew, with much improved positions of many of the stars and with modern elements of reduction. The series of observations thus available include the long one of Olbers (*Berliner astronomisches Jahrbuch*, 1818), and those of Greenwich, Paris, and Dorpat. It is a work which, together with the recalculation of the perturbations to the next perihelion passage, may perhaps be made the subject of a prize by one or other of our scientific academies; on the last return of Halley's comet, the first approximation to the epoch of arrival at perihelion was due to action of this kind on the part of the Academy of Turin, and though a much higher degree of interest attached to the reappearance of that famous body, we do not despair to see Olbers' comet deemed worthy of a new and more refined calculation.

If these cometary bodies wandering into the confines of the solar system from the stellar spaces are fixed therein by the action of one or other of the planets, it will have been owing to a very close approach to the planet Mars that Olbers' comet presented itself in 1815, moving in an ellipse of moderate dimensions. The nearest approach of the two orbits in that year was 0.07 in 86°.4 heliocentric longitude, but this distance must have varied in successive revolutions through the perturbations of the other planets, and at some past time there may have been an intersection of the orbits and a close encounter of the two bodies.

METEOROLOGICAL NOTES

BEFORE the commencement of the summer rains this year Mr. Eliot, the officiating meteorological reporter to the Government of India was called upon for a report on the prospects of the season. His reply, to which we have already referred in the "Notes," consisted of a short *résumé* of the most important characteristics of the south-west monsoons of recent years, from which the following conclusions were deduced:—"1. The persistent excessive pressure over Northern India at the present time (June, 1878), tends to diminish the baric gradient between Southern Asia and the Mid-Indian Ocean, and if this is not compensated by increased pressure over the sea area to the South of India, the monsoon current will be below its average strength. 2. There appear to be no strongly-marked abnormal variations of pressure over Northern India. It is therefore probable that the rainfall will be much more equally distributed than last year. 3. Comparing the present year with 1865, it is probable that the heavy rainfall during the cold weather, and more especially in May, will slightly retard the advent of the monsoon in Upper India. 4. The probable effect of the low pressure along the Bombay coast cannot be determined except by comparison with last year. It appears to promise fairly abundant rain over that portion of the country." These conclusions have now been subjected to the test of experience and are found to have been verified in almost every particular. The southerly current from the Indian Ocean has been decidedly below its normal strength; the rains set in from a fortnight to a month after the usual time; every district in the country has received a moderate supply of rain, though the average rainfall for the whole country has been less than usual, and over the Bombay Presidency, from Belgarum to Kurrachee, the rainfall has been in excess of the average for previous years. The only peculiarity of the monsoon of 1878, that was not predicted, was the frequent recurrence of heavy falls of rain over a few small and well-defined areas; but this would seem to be the character of the rainfall of every year in which the monsoon current is of less than the usual strength. The percentage of verifications reached by Mr. Eliot has thus been as great as that attained by the American observers, and the predictions in his case were made months, not days or hours, in advance. The same meteorologist has recently made a discovery which promises to be of the greatest possible value in connection with the system of storm-warnings to the ports round the Bay of Bengal. It is that a cyclonic vortex, when generated in the middle of the Bay, always travels towards that part of the coast where the wind velocity for the time being is least in comparison with the average velocity for the same place and time of year. This law has been verified by almost all the cyclonic disturbances that have occurred in the Bay since a chain of meteorological observatories was established round it, and it lends a great deal of support to the theory that a cyclonic vortex is developed through the accumulation, concentration, and condensation of aqueous vapour over a region of comparative calm. All that appears now wanted to

render cyclone prognostications for the Bay of Bengal almost absolutely certain is a submarine cable to the Andaman and Nicobar Islands, by which the meteorological stations on these islands, near the place of origin of all the great cyclones of the Bay, would be brought into telegraphic communication with the rest of the empire.

IN his "Tenth Contribution to Meteorology," which appears in the *American Journal of Science and Arts* for the present month, Prof. Loomis gives the results of an examination he has made as to the course of seventy-seven storms after leaving the eastern coast of the United States, these storms having occurred from March, 1874, to November, 1875. Of these seventy-seven storms he was able to follow thirty-six of them entirely across the Atlantic Ocean, eight of them, however, becoming merged in other storms before reaching Europe. The annual average of storms which are found to cross the Atlantic from the United States to Europe is eighteen, and nearly all of these storms pursued a course north of east, passing in their eastward course considerably to the north of Scotland; indeed, in only four of the storms did the centre pass as far south as the north of England. Prof. Loomis concludes that, when a storm with a centre depression at least below 29.5 inches leaves the coast of the United States, the probability that it will pass over any part of England is only one in nine; that it will occasion a gale anywhere near the English coast, one in six; and that it will give rise to a fresh breeze, one in two. A characteristic feature of these storms is the slow rate of their onward progress in crossing the ocean, as compared with their rate over the United States—a feature of the utmost possible importance in attempting to predict the time of their descent on the shores of Europe of those American storms which cross the Atlantic. About half of the whole number of the storms originated in the neighbourhood of the Rocky Mountains, five in or near Texas, and four were distinctly traced to the Pacific coast. Of six West India cyclones which occurred in the same time only two could be traced across the Atlantic, and even one of these became blended with another storm. The rest of the paper is taken up with a discussion of the fluctuations of the barometer on Mount Washington, 6,285 feet, and Pike's Peak, 13,960 feet, as compared with what takes place on the level ground at the base of these mountains. As regards Mount Washington, the valuable result is arrived at that the diurnal maxima and minima of the barometer occur more than three hours later at the summit than at the base, showing an average retardation of one hour for each 900 feet of elevation. In the case of Pike's Peak, the rate of retardation is one hour for an elevation of 1,380 feet. It is evident from these figures that the law of the rate of retardation is yet to be sought, one of the most important factors, in all probability, being the absence or presence of high plateaux and their extent near the high station, to which must be added the latitude of the place. Observations of the wind at these high levels show, just as at places near sea-level, a circulation about a low centre, the movement of the wind being approximately at right angles to the direction of the low centre; and further, that at the height of Mount Washington, the low centre of storms sometimes lags behind the low centre at the surface of the earth as much as 200 miles. This last result is so vital in the theory of storms as to demand a much more extended examination, the most special care being taken that the retardation of the time of occurrence of the diurnal barometric minima be allowed for in the discussion.

IT is with extreme satisfaction we learn that at a recent meeting of the Council of the Scientific Association of France, M. Mascart, Director of the Meteorological Department, submitted a proposal from the Departmental Commission of Vaucluse, for the establishment of an

observatory on the top of Ventoux, situated to the north-east of Carpentras, and rising above all the surrounding summits to a height of 6,300 feet above the sea. This observatory in the south of France, along with the observatories of Puy de Dôme in the north, and of Pic du Midi in the south-west, may be regarded as furnishing France with an enviable system of elevated observatories for meteorological observations such as no other country possesses, thus putting French physicists in possession of the essential data whence the more difficult meteorological problems may be attacked, and the systems of weather-warnings for navigation and agriculture more rapidly developed and improved. It is estimated that 150,000 francs will be required to establish the station, of which sum there are already subscribed by M. R. Bischoffsheim 10,000 francs, by the Commune of Bédoin, situated at the foot of Mt. Ventoux, 10,000 francs, the Council of the Scientific Association 500; and as the Meteorological Commission of Vaucluse has opened a subscription-list, the General Council of the Department has promised to aid in forming the roadway up the mountain, and a subsidy is looked for from the Minister of Public Instruction, the establishment of this important observatory will doubtless soon become an accomplished fact.

GEOGRAPHICAL NOTES

WITH reference to the reports that Prof. Nordenskjöld's vessel had got shut in by the ice near East Cape, in Behring Strait, the Committee for Promoting Russian Trade and Industry have resolved to apply to the Governor-General of Eastern Siberia, requesting him to assist in instituting a search for Prof. Nordenskjöld, and in obtaining more certain information as to the situation of the expedition. Mr. W. H. Dall, the well known U.S. Alaska explorer, has written a letter to an acquaintance in Stockholm, mentioning the previously-reported statement of whalers, from which it is supposed that the *Vega*, has been stopped by ice east of Cape East. Should this be the case, Mr. Dall entertains no fears for the fate of the expedition. If these suppositions be correct, he says, "the breaking up of the ice next July will leave open water for the *Vega* to proceed to Behring Strait. Vessels pass to westward of East Cape every year. There is a creek there. (The letter here gives a sketch map describing a bay, with a small island in the middle of it, and an anchorage inside.) A river with fresh water runs into the bay, and on the coast is a native village. This is not marked in the ordinary maps and charts, and it is just here that the vessel, according to the reports of the natives, must be lying. She can safely winter there. There is a large village, inhabited by Tchuktchees, who would be able to supply fresh meat. This place is situate not more than 200 English miles from the white men's trading station at Plover Bay. If the *Vega* is lying there, the success of the operation is practically achieved, because, as I said, the bay is open every year, and does not get closed by ice until October. Vessels sail there, and carry on trade every summer."

THE last number of the *Isvestia* of the Russian Geographical Society contains an interesting paper by M. Grigorieff, on the temperature and density of water in the Arctic Ocean, along the coast of Russian Lapland, and in the White Sea, being the result of observations carefully made on board the schooner *Samoyede*, by means of good instruments. As to the Arctic Ocean, M. Grigorieff confirms the existence of a warm branch of the Gulf Stream which flows along the coast as far as Gavrilovskiye Islands, and thence turns due east to the Kanin Peninsula and Kolgueff Island, and further, to the Moller Bay on Novaya Zemlya. Beneath this warm current there is a cold one flowing in an opposite direction at some depth. When it meets with a rising bottom, and especially with the deep bank of less than 100